



Palo Verde Nuclear  
Generating Station

Gregg R. Overbeck  
Vice President  
Nuclear Production

TEL 602/393-5148  
FAX 602/393-6077

Mail Station 7602  
P.O. Box 52034  
Phoenix, AZ 85072-2034

192-00993 - GRO/DGM/KR  
June 19, 1997

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
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Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)**  
**Unit 1**  
**Docket No. STN 50-528**  
**License No. NPF-41**  
**Licensee Event Report 97-001-00**

Attached please find Licensee Event Report (LER) 97-001-00 prepared and submitted pursuant to 10 CFR 50.73. This LER reports an automatic reactor trip following the load shed of two of four reactor coolant pumps. In accordance with 10CFR50.73(d), a copy of this LER is being forwarded to the Regional Administrator, NRC Region IV. If you have any questions, please contact Daniel G. Marks, Section Leader, Nuclear Regulatory Affairs, at (602) 393-6492.

Sincerely,

GRO/DGM/KR/kr

Attachment

cc: E. W. Merschoff (all with attachment)  
K. E. Perkins  
F. L. Brush  
INPO Records Center

IE221

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9707030068 970619  
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# CATEGORY 1

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ACCESSION NBR:9707030068      DOC.DATE: 97/06/19      NOTARIZED: NO      DOCKET #  
 FACIL:STN-50-528 Palo Verde Nuclear Station, Unit 1, Arizona Publi      05000528  
 AUTH.NAME      AUTHOR AFFILIATION  
 MARKS,D.G.      Arizona Public Service Co. (formerly Arizona Nuclear Power  
 OVERBECK,G.R.      Arizona Public Service Co. (formerly Arizona Nuclear Power  
 RECIP.NAME      RECIPIENT AFFILIATION

SUBJECT: LER 97-001-00:on 970527,reactor space trip occurred  
 following RCP load shed.Caused by degraded fuse on bus  
 voltage potential transformer.Fuse was replaced & NAN-S01's  
 PT & connections were checked satisfactory.W/970619 ltr.

DISTRIBUTION CODE: IE22T      COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 6  
 TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

NOTES:STANDARDIZED PLANT

05000528

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INTERNAL:	ACRS	1 1	AEOD/SPD/RAB	2 2
	AEOD/SPD/RRAB	1 1	FILE CENTER	1 1
	NRR/DE/ECGB	1 1	NRR/DE/EELB	1 1
	NRR/DE/EMEB	1 1	NRR/DRCH/HHFB	1 1
	NRR/DRCH/HICB	1 1	NRR/DRCH/HOLB	1 1
	NRR/DRCH/HQMB	1 1	NRR/DRPM/PECB	1 1
	NRR/DSSA/SPLB	1 1	NRR/DSSA/SRXB	1 1
	RES/DET/EIB	1 1	RGN4 FILE 01	1 1
EXTERNAL:	L ST LOBBY WARD	1 1	LITCO BRYCE,J H	1 1
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# LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) **Palo Verde Unit 1** DOCKET NUMBER (2) **05000528** PAGE (3) **1 OF 05**

TITLE (4) **Reactor Trip Following Reactor Coolant Pump Load Shed from Non-Class 1E 13.8 kV Bus**

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBERS	
05	27	97	97	001	00	06	19	97	N/A	050000	
									N/A	050000	

OPERATING MODE (9) **1** THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more of the following) (11)

POWER LEVEL (10) <b>100</b>	20.402(b)	20.405(c)	<input checked="" type="checkbox"/>	50.73(a)(2)(iv)	73.71(b)
	20.405(a)(1)(i)	50.36(c)(1)		50.73(a)(2)(v)	73.71(c)
	20.405(a)(1)(ii)	50.36(c)(2)		50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 386A)
	20.405(a)(1)(iii)	50.73(a)(2)(i)		50.73(a)(2)(viii)(A)	
	20.405(a)(1)(iv)	50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)	
	20.405(a)(1)(v)	50.73(a)(2)(iii)		50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME **Daniel G. Marks, Section Leader, Nuclear Regulatory Affairs** TELEPHONE NUMBER **602393-6492**

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
X	E	B	FUG	080	N				

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE) ☐ NO ☒ X

EXPECTED SUBMISSION DATE (15)

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On May 27, 1997, at approximately 0034 MST, Palo Verde Unit 1 was in Mode 1 (POWER OPERATION), operating at approximately 100 percent power when an automatic reactor trip occurred on low departure from nucleate boiling ratio (DNBR) following the load shed of two reactor coolant pumps (RCP). The non-Class 1E 13.8 kV electrical bus (NAN-S01) performed a load shed of two of the four RCPs on an indicated undervoltage signal. The core protection calculator (CPC) generated a reactor trip on low DNBR due to low RCP speed. By approximately 0352 MST, the unit was stabilized in Mode 3 (HOT STANDBY) and the Shift Supervisor classified the event as an uncomplicated reactor trip. There were no engineered safety features (ESF) actuations and none were required. Required safety systems responded to the event as designed.

The cause of the indicated undervoltage signal and subsequent load shed was attributed to a degraded fuse on the bus voltage potential transformer (PT). As corrective action, the fuse was replaced. NAN-S01's PT and connections were checked satisfactory. A transportability review was performed to check the remaining non-Class 1E 4.16 kV and 13.8 kV PT fuses in Unit 1 associated with load shedding and synchronizing. Similar fuses in Units 2 and 3 have been checked.

A previous similar event was reported in LER 529/89-009-00.

# LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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**TEXT**

**1. REPORTING REQUIREMENT:**

This LER 528/97-001-00 is being written to report an event that resulted in the automatic actuation of an Engineered Safety Feature (ESF) (JE), including the Reactor Protection System (RPS) (JC) as specified in 10 CFR 50.73(a) (2) (iv).

Specifically, on May 27, 1997, at approximately 0034 MST, Palo Verde Unit 1 was in Mode 1 (POWER OPERATION), operating at approximately 100 percent power when an automatic reactor (AC) trip occurred on low departure from nucleate boiling ratio (DNBR) following the load shed of two reactor coolant pumps (RCP) (AB). The non-Class 1E 13.8 kV electrical bus (NAN-S01) (EA) performed a load shed of two of the four RCPs on an indicated undervoltage signal. The core protection calculator (CPC) (JC) generated a reactor trip on low DNBR due to low RCP speed.

**2. EVENT DESCRIPTION:**

Prior to the event, at approximately 0014 MST on May 27, 1997, Control Room personnel (utility-licensed operator) received a 13.8 kV switchgear bus trouble alarm and observed indications that NAN-S01 voltage was low (reading approximately 12 kV). Control Room personnel observed that RCP and circulating water pump (CWP) (KE) motor amps, as well as voltages on the non-Class 4.16 kV electrical bus (NBN-S01) (EA) and load centers (EB) fed from NAN-S01, were normal. In accordance with the alarm response procedure, an auxiliary operator (AO) (utility nonlicensed operator) was dispatched to investigate the local status of NAN-S01. Although the AO reported that there were no relay flags triggered on the 13.8 kV breakers, local voltage indications on the B-C phase of NAN-S01 were low. APS electrical maintenance personnel (other utility personnel) were contacted to troubleshoot the event.

At approximately 0034 MST, NAN-S01 performed a load shed on indicated undervoltage (approximately 10.56 kV), resulting in the loss of RCP 1A and 2A, as well as CWPs and several load centers. The CPC Flow program detected RCP speed less than 95 percent of rated speed and generated DNBR and local power density (LPD) trip signals. At approximately 0034 MST, the reactor automatically tripped on low DNBR followed by high LPD signals, as expected. All control element assemblies (CEA) (AA) inserted as designed. The reactor trip was followed by a Main Turbine/Main Generator (TA/TB) trip. The Steam Bypass Control System (SBCS) (JI) responded as designed to control the secondary system pressure.



# LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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TEXT

By approximately 0352 MST, the unit was stabilized in Mode 3 (HOT STANDBY) and the Shift Supervisor (utility-licensed operator) classified the event as an uncomplicated reactor trip. At approximately 0354 MST, reenergization of NAN-S01's load centers was initiated. There were no ESF actuations and none were required. Required safety systems responded to the event as designed.

3. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATIONS OF THIS EVENT:

A safety limit evaluation was performed as part of the APS Incident Investigation. The evaluation determined that the plant responded as designed, that no safety limits were exceeded, and that the event was bounded by current safety analyses.

The reactor trip experienced by Unit 1 did not result in a transient more severe than those already analyzed in the Updated Final Safety Analysis Report (FSAR) Chapter 15 or Chapter 6. The event is characterized as a Loss of Reactor Coolant (AB) Flow event. The licensing basis event is presented in the Updated FSAR 15.3.1 (Total Loss of Reactor Coolant Flow). The reactor tripped from 100 percent power due to a CPC-generated reactor trip on low DNBR caused by low RCP speed. There is no indication that the DNBR specified acceptable fuel design limits (SAFDL) were violated nor would any violation be expected based on the more limiting scenarios in the Updated FSAR.

The primary and secondary system pressure boundary limits were not approached. The event did not result in any challenges to the fission product barriers or result in any release of radioactive materials. Therefore, there were no adverse safety consequences or implications as a result of this event. This event did not adversely affect the safe operation of the plant or health and safety of the public.

4. CAUSE OF THE EVENT:

An independent investigation of this event is being conducted in accordance with the APS Corrective Action Program. As part of the investigation, a determination of the cause of the event was performed. The cause of the reactor trip was attributed to a degraded PT fuse (SALP Cause Code E: Component Failure) which caused a load shed on NAN-S01 resulting in a partial loss of reactor coolant flow. The cause of the component failure and the failure mode, mechanism, and effect of the failed component is discussed in Section 5.

# LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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TEXT      No unusual characteristics of the work location (e.g., noise, heat, poor lighting) directly contributed to this event. No personnel errors or procedural errors contributed to this event.

5.      STRUCTURES, SYSTEMS, OR COMPONENTS INFORMATION:

An independent investigation of this event is being conducted in accordance with the APS Corrective Action Program. As part of the investigation, a determination of the cause of the event was performed. The cause of the NAN-S01 load shed malfunction described in Section 2 has been determined to be a failed potential transformer (PT) fuse. The PT is connected to NAN-S01. The fuse is located between the PT and the bus. Relay 227-S monitors the bus voltage through the PT. The relay load sheds the bus when the voltage is less than or equal to 77 percent of the bus nominal voltage (13.8 kV). The failure of the PT fuse resulted in a load shed of NAN-S01 including deenergization of the RCPs 1A and 2A. This resulted in a reactor trip. Shortly before the reactor trip, there was indication of a problem with NAN-S01 by a trouble alarm annunciation for the bus. Operations personnel were attempting to identify the problem when the reactor trip occurred.

The degraded PT fuse was discovered as a result of troubleshooting performed after the event. The degraded fuse was manufactured by General Electric (GE). It is a type EJ1, size B, rated at 15.5 kV and 0.5 amps. The model number is GE 9F60BHH905. The degraded fuse has been sent to GE for a root cause of failure analysis. The APS evaluators (other utility personnel) expect that the cause of the fuse degradation will be similar to the previous analysis performed by GE, as discussed in Section 7. If the evaluation results differ significantly from this determination, a supplement to this report will be submitted to describe the final root cause determination.

There is no indication that any structures, systems, or components were inoperable at the start of the event which contributed to this event. No failures of components with multiple functions were involved. No failures that rendered a train of a safety system inoperable were involved.

6.      CORRECTIVE ACTIONS TO PREVENT RECURRENCE:

An independent investigation of this event is being conducted in accordance with the APS Corrective Action Program. Actions to prevent recurrence are being developed based upon the results of the investigation and will be tracked to completion under the PVNGS Commitment Action Tracking System. As immediate corrective action, the fuse was replaced. NAN-S01's PT and connections were checked satisfactory. A

# LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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						0 5 of 0 5

TEXT

transportability review was performed to check the remaining non-Class 1E 4.16 kV and 13.8 kV PT fuses in Unit 1 associated with load shedding and synchronizing. Similar fuses in Units 2 and 3 have been checked. The current design will be reviewed to determine if a plant change is appropriate to prevent a bus load shed on a single failure.

7. PREVIOUS SIMILAR EVENTS:

A similar event has been reported pursuant to 10 CFR 50.73 under LER 529/89-009-01. On July 12, 1989, Palo Verde Unit 2 was operating at approximately 100 percent power when two of the four RCPs were load shed from the non-Class 1E 13.8 kV electrical bus NAN-S02, resulting in an automatic reactor trip on calculated low DNBR due to low RCP speed. The cause of the load shed was a failed fuse in the 13.8 kV bus potential transformer (PT). The manufacturer (GE) analysis concluded that the fuse failure was probably initiated by a previous current surge on the system. The surge damaged the fuse which effectively reduced its rated continuous current capacity. This caused the fuse to melt slowly over time at currents below its minimum interrupt rating. The degraded fuse was replaced in the PT for NAN-S02. APS engineering identified other PT fuses that may have been subjected to an over-voltage condition and replaced them. Following this event, a preventative maintenance task was instituted to check the fuses for resistance readings every other outage. Although the corrective actions taken for the previous event did not prevent this event, approximately eight years has passed between this type of fuse failure.

8. ADDITIONAL INFORMATION:

Based on reviews by the Plant Review Board, the Management Response Team, and the Incident Investigation Team, unit restart was authorized by the Operations Director in accordance with approved procedures. On May 30, 1997, at approximately 1700 MST Unit 1 entered Mode 2 (STARTUP), on May 31, 1997, at approximately 0027 MST Unit 1 entered Mode 1, and on May 31, 1997, at approximately 0559 MST Unit 1 was synchronized on the grid.